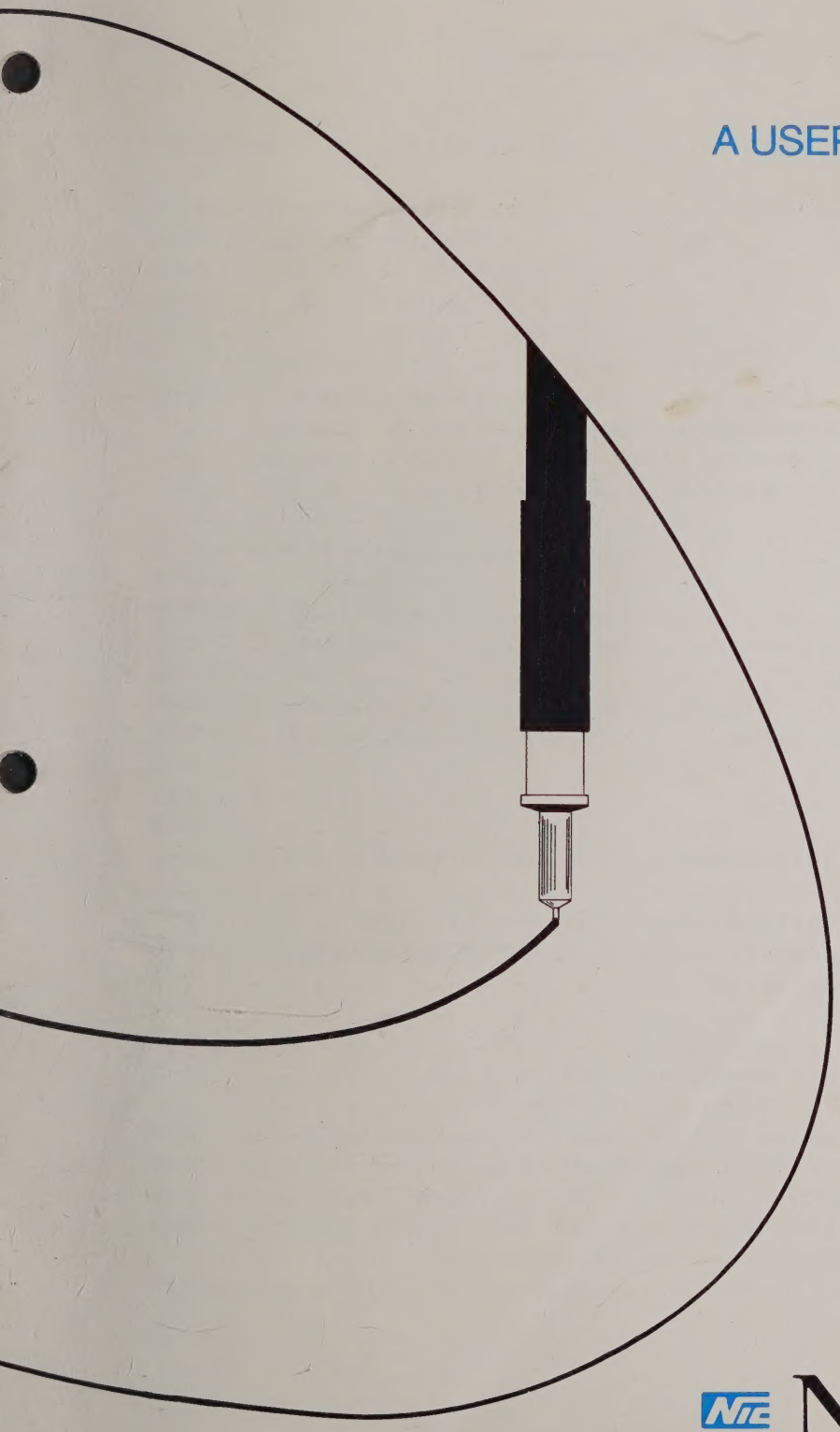


A USER GUIDE to

# ink
# pens
# plotting media

for

ZETA PLOTTERS

Nicolet

Publication 431-071

## Table of Contents

SECTION I INTRODUCTION

1-1 System Overview . . . . . 1-1
1-2 Considerations . . . . . 1-1

SECTION II VARIABLES

2-1 Introduction . . . . . 2-1
2-2 Pen & Media Types Supported . . . . . 2-1
2-3 Pen and Media Combinations . . . . . 2-2
2-4 Pen Type Considerations . . . . . 2-2
2-5 Ballpoint . . . . . 2-3
2-6 Nylon-Tip . . . . . 2-3
2-7 Liquid-Roller . . . . . 2-3
2-8 Liquid-Ink . . . . . 2-3
2-9 Plotting Media Considerations . . . . . 2-4
2-10 Translucent . . . . . 2-4
2-11 High-Quality, Glossy Bond . . . . . 2-4
2-12 Vellum Type Media . . . . . 2-4
2-13 Clear Inking Film . . . . . 2-4
2-14 Acetate . . . . . 2-5
2-15 Mylar . . . . . 2-5
2-16 Plotter Considerations . . . . . 2-5
2-17 Pen Force . . . . . 2-5
2-18 Up/Down Actuation Time - Pen Delay Time . . . . 2-5
2-19 Acceleration/Deceleration and Plotting Speed . . 2-6
2-20 Liquid Ink Considerations . . . . . 2-6
2-21 Pen Points . . . . . 2-6
2-22 Ink Types . . . . . 2-7
2-23 Ink for Paper and Clear Inking Film . . . . . 2-7
2-24 Ink for Mylar Film and Vellum K . . . . . 2-7
2-25 Ink for Acetate Film . . . . . 2-7
2-26 Liquid Ink Accessory Equipment . . . . . 2-8
2-27 Point Magnifier Glass . . . . . 2-8
2-28 Pressure Pen Cleaner . . . . . 2-9
2-29 Double Compartment Pen Cleaner . . . . . 2-9
2-30 Ultrasonic Cleaner . . . . . .2-10

## Table of Contents (Cont'd)

SECTION III OPERATION AND MAINTENANCE

3-1 Introduction . . . . . 3-1
3-2 Liquid-Ink Pens . . . . . 3-1
3-3 Liquid-Ink Pen Filling . . . . . 3-2
3-4 Pen Priming . . . . . 3-3
3-5 Testing and Installing Pen . . . . . 3-3
3-6 When Plotting is Completed . . . . . 3-3
3-7 Pen Cleaning . . . . . 3-6
3-8 Summary of Key Operating Suggestions for Liquid Ink 3-8
3-9 Ballpoint Pens . . . . . 3-9
3-10 Liquid-Roller Pens . . . . . 3-9
3-11 Nylon-Tip Pens . . . . . 3-9
3-12 Plotting Media Operation . . . . . 3-9
3-13 Translucent . . . . . 3-9
3-14 High-Quality, Glossy Bond . . . . . .3-10
3-15 Vellums . . . . . .3-10
3-16 Mylar . . . . . .3-10
3-17 Acetate Film . . . . . .3-11
3-18 Clear Inking Film . . . . . .3-11

SECTION IV FREQUENT QUESTIONS/ANSWERS 4-1

APPENDIX A GLOSSARY OF TERMS A-1

## List of Tables

2-1 ZETA Plotter Pen & Media Types Supported . . . . . 2-1
2-2 Results of Pen & Media Combinations . . . . . 2-2
2-3 Pen Life Comparison . . . . . 2-2
2-4 Nominal Liquid-Ink Pen Tip Widths . . . . . 2-3

## List of Illustrations


| Figure | | Page |
|---|---|---|
| 1-1 | Interaction Between Variables | 1-2 |
| 2-1 | Point Magnifier Kit | 2-8 |
| 2-2 | Pen Cleaning/Starting Kit | 2-9 |
| 2-3 | Pen Cleaner and Fluid | 2-9 |
| 2-4 | Ultrasonic Cleaner | 2-10 |
| 3-1 | Pen Tip Operation | 3-1 |
| 3-2 | Pen Tip and Barrel | 3-2 |
| 3-3 | Filling Liquid-Ink Pen | 3-2 |
| 3-4 | Pen Priming | 3-3 |
| 3-5 | Pen Point Disassembled | 3-5 |
| 3-6 | Pen Point Inspection, End View | 3-5 |
| 3-7 | Pen Point Inspection, Side View | 3-6 |

# SECTION I

# INTRODUCTION

## 1-1 SYSTEM OVERVIEW

To understand how to produce consistent, high-quality plots using a digital plotter, it is helpful to view the entire system. This includes ink, pen, media and plotter, each of which has several interacting variables. For this reason, system considerations are important when selecting a particular component. The system approach to component selection can be undertaken only if you have an understanding of each component's variables and their interaction.

The quality of a plot comes into focus at the point of contact where the pen tip touches the media. At this point, the final results of your investment and time are produced. Nicolet Zeta Corporation (NZC) has engineered and selected specific pen bodies, inks and media to optimize the capabilities of ZETA Plotters for a broad range of applications. This total system approach assures superior quality and operation of even the most demanding plotting requirements.

## 1-2 CONSIDERATIONS

Variables associated with the plotter are pen force, up/down actuation time, acceleration, deceleration and plotting speed. Pen variables include ink flow-rate, point material, care, wear and maintenance, and point size. Ink variables include viscosity, drying rate, open-pen time, and opacity. Media variables are types of material and surface.

The interaction between variables is complex. For example, the drying rate of the ink will vary when used on different media surfaces/materials. Additionally, the drawing speed and pen flow-rate are affected by changes of drying rate. All of the variables can influence plot quality, and are shown in Figure 1-1.

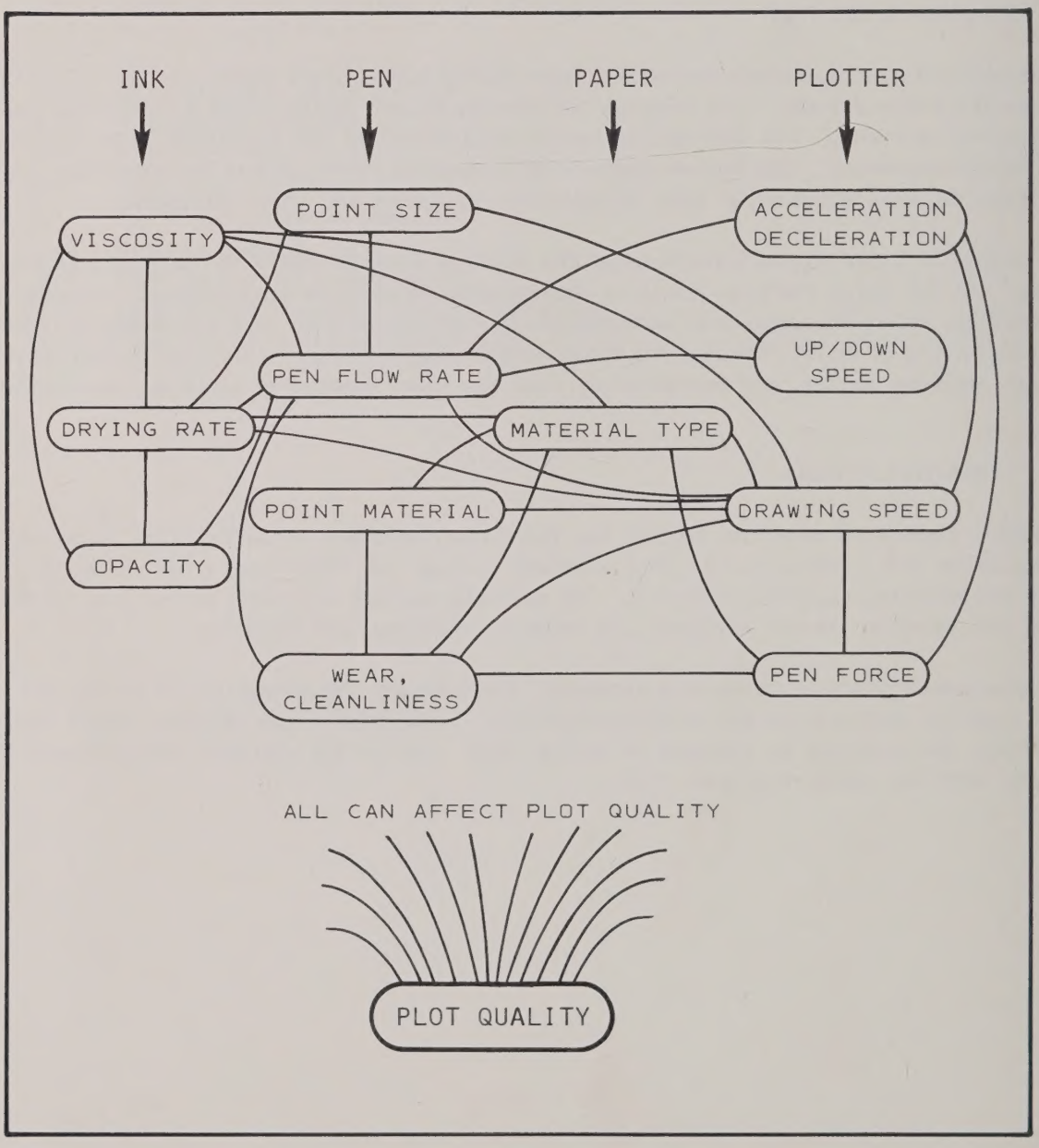



Figure 1-1 Interaction Between Variables

# SECTION II

# VARIABLES

## 2-1 INTRODUCTION

This section describes the various types of pens, plotting media, ink and plotter characteristics that influence plot quality. This will provide you the information to successfully select components that will achieve optimum results for your application. Each of the four components of the plotting system should be selected with regard to the following:

a. Suitability for the application.

b. Compatibility with the other components selected to produce the desired results.

## 2-2 PEN & MEDIA TYPES SUPPORTED

Not all pen and media types are supported by all ZETA plotters. While this publication discusses all types of pens, inks and media, the applicability of these to a specific ZETA plotter model is shown in Table 2-1.

Table 2-1 ZETA Plotter Pen & Media Types Supported

| Pen or Media Type | ZETA 8 ZETA 887 | ZETA 822 | ZETA 3610 ZETA 3620 ZETA 5400 | 3653SX 1453SX |
|---|---|---|---|---|
| Nylon-tip | Yes | Yes | Yes | Yes |
| Liquid-roller | Yes | Yes | Yes | Yes |
| Liquid Ink | * | Yes | Yes | Yes |
| Ballpoint | * | * | Yes | Yes |
| Translucent | Yes | Yes | Yes | Yes |
| Glossy Bond | Yes | Yes | Yes** | Yes |
| Clear Film | Yes | Yes | * | * |
| Acetate | Yes | No | No | No |
| Vellum K | * | * | * | Yes |
| Vellum E | Yes | Yes | Yes | Yes |
| Mylar | * | Yes | Yes | Yes |

* Not available at time of printing, contact NZC for availability.

** Glossy Bond for ZETA 5400 in 36-inch width narrow paper size only.

## 2-3 PEN AND MEDIA COMBINATIONS

The results of pen and media combinations are shown in Table 2-2. The recommended combinations are labeled GOOD. Those combinations labeled FAIR can be useful in certain applications, and those labeled POOR are not recommended.

Table 2-2 Results of Pen & Media Combinations

| Media | Ballpoint | Liquid Roller | Nylon-tip Water Base | Nylon-tip Solvent Base | Liquid Ink Water Base | Liquid Ink Solvent Base |
|---|---|---|---|---|---|---|
| Translucent | GOOD* | GOOD | GOOD | GOOD | GOOD | GOOD |
| Vellum E | GOOD* | GOOD | GOOD | GOOD | GOOD | GOOD |
| Vellum K | GOOD* | POOR | GOOD** | GOOD | POOR | GOOD |
| Glossy Bond | GOOD* | GOOD | GOOD | GOOD | GOOD** | GOOD** |
| Clear Film | POOR | POOR | GOOD | GOOD | FAIR | FAIR |
| Acetate | POOR | POOR | POOR | GOOD | POOR | GOOD |
| Mylar | GOOD* | FAIR | FAIR** | GOOD | FAIR** | GOOD |

* Ballpoints will draw at high speed, but do not provide excellent reprographic quality.

** Inks well, but smears easily.

## 2-4 PEN TYPE CONSIDERATIONS

Two considerations of pen type are running life and shelf life. Running life is usually expressed in feet (meters), shelf life in months. Temperature can have a significant affect on both shelf and running life. Increased temperature will shorten the life of nylon-tip and liquid-roller pens drastically. Table 2-3 compares the average pen life at nominal 70°F (21°C) room temperature.

Table 2-3 Pen Life Comparison

| Pen Type | Shelf Life | Running Life |
|---|---|---|
| Ballpoint | 60 Months | 20,000 ft (7000 m) |
| Nylon-tip | 12 Months, Sealed Package | 1500-2000 ft (450-700 m) |
| Liquid-roller | 12 Months, Capped | 2000 ft (700 m) |
| Liquid-Ink* | 12 Months, Sealed Bottle | 500-3000 ft/full reservoir (175-1000 m) |

* Running life depends on size of pen tip and type of ink.

### 2-5 Ballpoint

Fine to medium line, high speed, economical, wide color selection. Fair photocopy reproducibility, and as with all ballpoint pens, a tendency to not produce solid lines because of occasional small skips. On the positive side, long life and consistent line width during life. Unlimited open-pen time. The nominal line width for fine ballpoint pens is 0.007 inches.

### 2-6 Nylon-Tip

Fine line, medium/low speed, excellent photocopy reproducibility. Wide color selection. Finite shelf life. Line width varies with wear. Water-based ink draws well on clear film, also available with solvent-based inks for use on acetate or Mylar material. Limited open-pen time, particularly with solvent-based inks. The nominal line width for fine nylon-tip pens is 0.020 inches.

### 2-7 Liquid-Roller

Liquid ink in a roller cartridge. Medium lines, wide color selection, excellent reproducibility and minimal user attention. Consistent line width. Moderate open-pen time. The nominal line width for liquid-roller pens is 0.012 inches.

### 2-8 Liquid-Ink

Fine to wide line selection, medium speed, wide color selection, excellent reproducibility. Requires user attention, but outstanding results. Consistent line width. Inks available for paper, Mylar, clear inking film and acetate materials. Limited open-pen time. Nominal line widths for liquid-ink pen tips are shown in Table 2-4. Widths of PL2-PL6 are recommended for the best performance.

Table 2-4 Nominal Liquid Ink Pen Tip Widths

| Numerical Designation | Color Code | Approximate Line Width | |
|---|---|---|---|
| PL0 | Ochre | 0.005" | 0.13 mm |
| PL1 | Violet | 0.007" | 0.18 mm |
| PL2 | Red | 0.010" | 0.25 mm |
| PL3 | Blue | 0.014" | 0.35 mm |
| PL4 | Green | 0.016" | 0.40 mm |
| PL5 | Yellow | 0.020" | 0.50 mm |
| PL6 | White | 0.024" | 0.60 mm |
| PL8 | Grey | 0.031" | 0.80 mm |
| PL10 | Black | 0.039" | 1.00 mm |

Line widths may deviate from nominal depending on type of surface, type of ink and plotting speed.

## 2-9 PLOTTING MEDIA CONSIDERATIONS

Plotting media includes Mylar, acetate, clear inking film and other types of film media as well as paper. Usually, the particular plotting application will dictate the preferred type of plotting media.

### 2-10 Translucent

Economical, semitransparent. Ideal low cost medium for most plotting. Good ballpoint, liquid-roller, nylon-tip and liquid ink receptivity. Manufactured to be stable at 72°F (22°C) and 50% relative humidity. Hard, smooth finish to minimize fiber build-up on pens.

### 2-11 High-Quality, Glossy Bond

This paper produces striking results. Glossy bond is coated on one side with a glossy, brilliant white finish. Superb results can be obtained with water-based nylon-tip pens. Liquid-roller and ballpoint pens can be used also. The paper will take liquid ink well, but the results will not be significantly better than with nylon-tip pens.

### 2-12 Vellum Type Media

**Vellum E -** Medium transparency. 100% rag paper permeated with a transparentizer that is permanent, non-yellowing, non-ghosting in erased area. Best with liquid-ink, nylon-tip and liquid-roller pens, will accept ballpoint. Good photocopy and diazo reproducibility.

**Vellum K -** Like Vellum E as described above, but less satisfactory results except with liquid ink. Tungsten pen-tips are recommended. Essentially, vellum K may be considered as having the same inking characteristics as Mylar.

### 2-13 Clear Inking Film

Clear and sturdy material for overhead projector viewgraphs. Will overlay and reproduce extremely well. Produces transparencies without the need for solvent-based inks that are very susceptible to quick drying. This is the best material for creating transparencies. Accepts standard water-base ink. Eliminates static build-up and curling problems. Accepts ink at high speed of up to 20 ips. Continuous rolls of 50 feet length for 12 inch plotters.

### 2-14 Acetate

This is also a clear and sturdy material for overhead projector viewgraphs. Moderately priced. Will overlay and reproduce extremely well. Moisture resistant. Sensitive to changes of temperature. Requires acetate film solvent-based ink. Not anti-static and tends to curl due to static cling.

### 2-15 Mylar

The ultimate in stability. Virtually unaffected by changes of temperature and humidity. Completely moisture resistant. Excellent for overlays and reproduction. Anti-static, low profile, smooth matte surface. Takes ballpoint, liquid-roller or solvent-based liquid ink and nylon-tip pens well. May be erased and redrawn without causing ghosting. The abrasive surface will shorten the life of liquid-roller pens. Tungsten liquid-ink pen tips should be used with liquid ink.

## 2-16 PLOTTER CONSIDERATIONS

The variables associated with the plotter are pen force, up/down actuation time, acceleration, deceleration and plotting speed. Pen up/down actuation time is referred to as Pen Delay Time (PDT). NZC has carefully engineered ZETA plotters to allow for providing optimum conditions for each combination of pen, ink and plotting media. All ZETA plotters allow you to set the speed, acceleration and PDT via terminal command. In addition, plotter controls allow you to make some adjustment of these parameters if a terminal is not available.

### 2-17 Pen Force

In older plotters, the pen force is applied by the spring in each pen cap/holder. Different cap/holders are used with different pen types (ballpoint, nylon tip, liquid roller liquid ink), and each type is factory adjusted for the proper force. In plotters designed within the past few years, the pen force is electronically controlled. These plotters include the ZETA 8, ZETA 822, ZETA 887, ZETA 3610, ZETA 3620 and ZETA 5400. These plotters allow you to change the force by setting a control. The pen pressure setting should be the minimum that will produce high quality plots consistently.

### 2-18 Up/Down Actuation Time - Pen Delay Time

The Pen Delay Time (PDT) terminal command, sets the pen delay time in milliseconds. This is the time associated with pen up (n1) and pen down (n2) movements. If n2 is not specified, the value of n1 is used. The PDT command allows you to set n1 and n2 independently. The ZETA 8, ZETA 822, and ZETA 887 automatically adjust the PDT when nylon-tip pens are used. The ZETA 822 automatically sets PDT, acceleration and speed to optimum conditions when the liquid-ink function is selected.

The pen types requiring higher pressure, such as ballpoint and liquid-roller, bottom out almost instantaneously. Thus, these pens are ready to write in a shorter time than nylon-tip or liquid-ink pens, which require a relatively minimal pressure. For these reasons, the higher pressure pen types can utilize a short PDT, and the lower pressure pen types require a longer PDT. The symptom of not enough pen delay time is ghosting at the start or tailing at the end of a pen down trace. Normally, the minimum pen up/down times consistent with no ghosting or tailing are used. For nylon-tip and liquid-ink pens, a PDT of 10 to 40 ms is recommended, depending on pen, line width, and drawing speed. The minimum PDT that will produce high quality plots consistently, should be used.

### 2-19 Acceleration/Deceleration and Plotting Speed

Acceleration and deceleration are controlled together by the electronics. All ZETA Plotters have speed control built-in via software. Since large (36-inch and larger) plotting applications more frequently have need for changes of speed, NZC has provided a front panel speed/acceleration control for operator use. On smaller ZETA plotters a control panel mode select function allows you to control the speed and acceleration independently. These parameters also may be controlled by software on all ZETA plotters. Speed is usually measured in inches per second (ips), or centimeters per second (cm/s). ZETA plotters provide a fast speed of 20 to 35 ips (51-89 cm/s) at maximum, depending on model. Slow speed is considered to be 15 ips (38 cm/s) or slower. Slow speeds will produce higher quality plots on clear inking film and acetate. Also, liquid ink will usually produce higher quality plots at slower speeds of 10-15 ips (25-38 cm/s).

## 2-20 LIQUID INK CONSIDERATIONS

The two key considerations are pen tip or point and ink type. Both of these have several variables and are discussed below.

### 2-21 Pen Points

Just as digital plotters differ greatly in design and capabilities, there is no truly universal plotting point. Due to the many variables, no single point will operate at maximum effectiveness in all types of plotting applications. There are two variables concerning pen points: material and size.

The hard chrome-plated stainless steel point is suitable for papers such as translucent and vellum at speeds of up to 10 inches per second.

The tungsten carbide point is suitable for papers and Mylar, clear inking film or acetate film at speeds up to 20 inches per second. Tungsten carbide points will wear less and last longer than steel; however, initial cost is greater.

Tungsten carbide points are available from NZC in point sizes from PL0 through PL10. Sizes PL3 through PL6 frequently are **used** in many applications. Refer to Table 2-4 for the sizes and nominal line widths for these points.

### 2-22 Ink Types

Liquid inks are available from NZC for different plotting media: paper, vellum, Mylar, clear inking film and acetate. One variable associated with inks is drying time. This must be traded off with open-pen time since the two are inversely related. It is apparent that fast drying is more desirable with higher speed plotting. However, good open-pen time is desirable from an operator point of view, to minimize pen clogging and cleaning frequency. Other variables include opacity, usually measured as a percentage of light transmitted; and ink flow, which relates to viscosity and is most important with higher speed plotting. Inks are available that are water-based and solvent-based. The solvent-based inks may be different for Mylar than for acetate.

### 2-23 Ink for Paper and Clear Inking Film (Water-based)

This water-based ink was designed for use with plotters. The papers include translucent, glossy bond and vellum E. Clear inking film uses the same ink. The black ink opacity is very black and the open-pen time is very good. It is also available in four opaque colors: red, green, blue and brown.

### 2-24 Ink for Mylar Film and Vellum K (Solvent-based)

**Black** - This ink was also designed for use with plotters. It has very black opacity and was formulated for good open-pen time. It contains a special high-speed additive to improve ink flow.

**Colors** - Available in four opaque colors: red, green, blue and brown. This ink was formulated for good open-pen time.

### 2-25 Ink for Acetate Film (Solvent-based)

This ink was designed for use with acetate materials and is very fast drying (with short open-pen time), since to reproduce well on acetate requires a solvent base ink which rapidly evaporates. It is available in black and six colors: red, green, blue, yellow violet and brown. It is (intentionally) moderately transparent so that it will display well in back-lighted displays such as overhead projection.

## 2-26 LIQUID INK ACCESSORY EQUIPMENT

In order to produce consistent, high quality liquid ink plots, it is mandatory to keep pen points clean and to replace worn points. NZC provides a selection of accessory equipment to enable the user to maintain the pen points in proper condition. These are described on the following pages.

### 2-27 Point Magnifier Glass

A Point Magnifier Glass is available from NZC with 25x magnification. This valuable tool makes possible quick on-the-job inspection of drawing points for wear and damage. In this way, a pen that begins making unsatisfactory traces may be inspected to determine if wear or dirt is the cause. Refer to Section III for use and operation information, and to Figure 2-1.

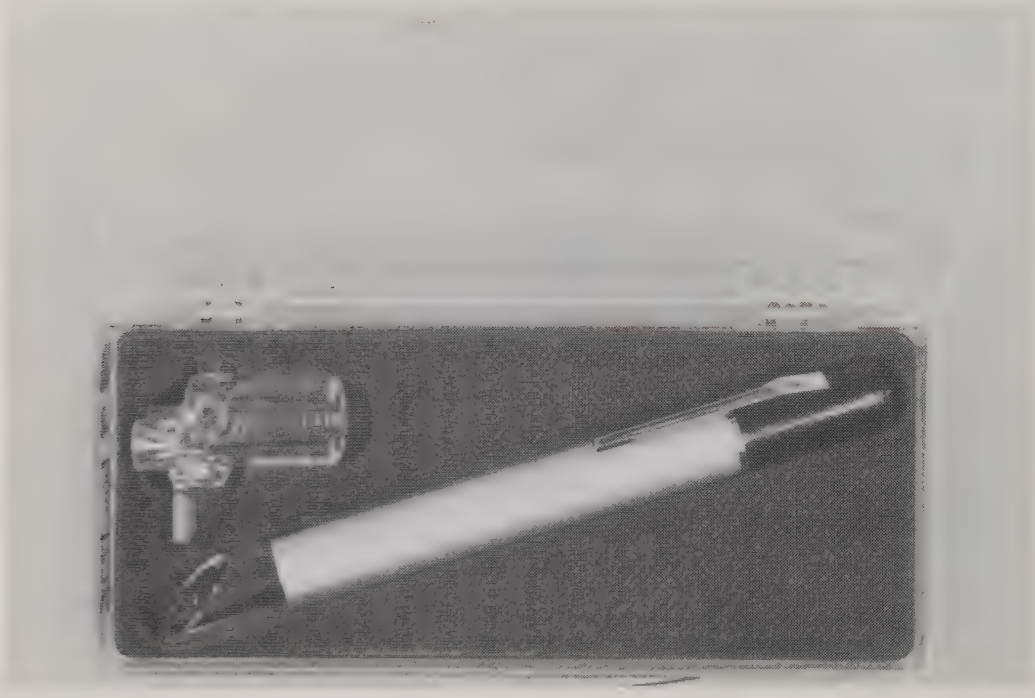


Figure 2-1 Point Magnifier Kit

### 2-28 Pressure Pen Cleaner

For ease of starting ink-flow through the pen and for on-the-spot cleaning, the fast effective method is with this pressure bulb. Pressure from the bulb forces the cleaning solution through all of the critical passages of the pen. A clear water rinse removes all chemical residues from within the pen. Refer to Section III for detailed operating information, and to Figure 2-2.

### 2-29 Double Compartment Pen Cleaner

A valuable aid with a unique double compartment plastic container permitting fast, convenient cleaning of all plotting pens and point. Refer to Figure 2-3.

Figure 2-2 Pen Cleaning/Starting Kit

Figure 2-3 Pen Cleaner and Fluid

### 2-30 Ultrasonic Cleaner

Does a quick, effective job on pen points. Designed to be used after completion of a plotting job, the ultrasonic cleaner and fluid will clean pen assemblies in a few minutes. Pens with accumulated dirt, dried ink, lint and foreign matter may also be cleaned, usually in several minutes. Several pen points may be cleaned at one time. Refer to Figure 2-4.

Figure 2-4 Ultrasonic Cleaner

# SECTION III

# OPERATION AND MAINTENANCE

## 3-1 INTRODUCTION

This section contains operating and maintenance information for each type of pen, and operating information on various types of plotting media. The pen types are discussed in the order of liquid-ink, ballpoint, liquid-roller and nylon-tip. Ballpoint pens require no maintenance. Liquid-roller and nylon-tip pens require little maintenance, except to keep pen caps on to prevent evaporation. Liquid-ink pens require considerably more attention. However, they also can produce outstanding results.

## 3-2 LIQUID-INK PENS

The use of the type of pen having a retractable ink feeder does limit the maximum speed at which the pens will operate. Figure 3-1 shows the conditions of the tip during operation. At faster writing speeds, tails will tend to develop since the pen cannot lift rapidly enough. Such conditions will, of course, vary in accordance with the pen and paper used.

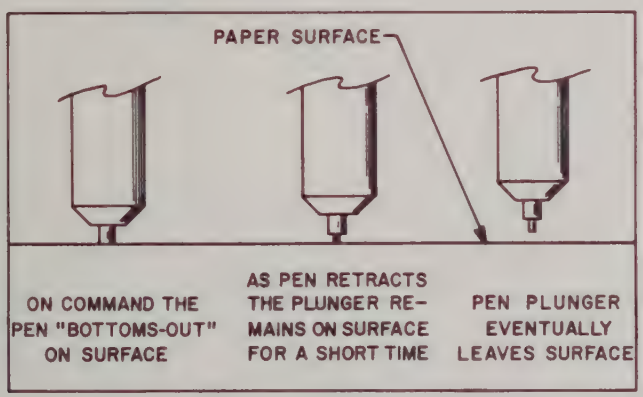

PAPER SURFACE
ON COMMAND THE PEN "BOTTOMS-OUT" ON SURFACE
AS PEN RETRACTS THE PLUNGER RE-MAINS ON SURFACE FOR A SHORT TIME
PEN PLUNGER EVENTUALLY LEAVES SURFACE

Figure 3-1 Pen Tip Operation

As shown in Figure 3-2, liquid-ink pens are comprised of two sub-assemblies: The pen point and the pen barrel or holder.

Figure 3-2 Pen Tip and Barrel

### 3-3 Liquid-Ink Pen Filling

The liquid-ink pen reservoir is filled to just below the threaded area with ink, as shown in Figure 3-3. It is necessary to keep ink off the threads; clean with non-lint Kim-wipe or equivalent if necessary.

Figure 3-3 Filling Liquid Ink Pen

When filled, the desired point should carefully be threaded into the pen without overtightening. Tighten until resistance is felt, lightly finger-tight. Do not use a pen wrench.

### 3-4 Pen Priming

Refer to Figure 3-4. To start the ink flow, use the bulb and nozzle with slight suction until ink enters the nozzle. Then test and install the pen and clean nozzle.

Figure 3-4 Pen Priming

### 3-5 Testing and Installing Pen

Use a scrap piece of plotting material or the edge of the material in the plotter near the sprocket holes. With a hard surface underneath the plotting material, draw several lines three to six inches long to test pen operation/ink flow. Install the pen as instructed in your plotter user manual.

### 3-6 When Plotting is Completed

In order to maintain high quality plotting, it is necessary to consistently clean the pens. This should be performed at the completion of each plotting cycle so that the ink does not dry in the pen. The open-pen time depends on ink type and on humidity. Never allow liquid ink pens to set overnight before cleaning.

### 3-7 Pen Cleaning

The following procedure is separated into Rinsing and Cleaning operations as follows:

**Rinsing -**

a. Lift the pen from the plotter pen carriage and invert the pen.

b. Carefully unscrew the pen point from the pen barrel.

c. Dispose of any remaining ink in the barrel by pouring into suitable container or drain.

d. Rinse barrel and pen point (do not disassemble pen point) in warm water until the water runs clean.

**Cleaning -**

a. Place the pen barrel(s) and pen point(s) into a suitable pen cleaner solution. NZC supplies both detergent base and solvent base cleaners. Any detergent may be used as a cleaning solution. If available, an ultrasonic cleaner is recommended. Ultrasonic cleaners are available from NZC.

b. After approximately one minute in ultrasonic cleaner, or one-half hour soaking, remove the pen point(s) and barrel(s).

c. Rinse with water and dry the barrels. They should be air dried.

d. Using a bulb (pressure pen cleaner), rinse the pen with water. The pen point screws into the bulb and may be used like a syringe to blow water through the pen point body.

e. Blow dry, preferably using pressure bulb.

Cleaning Pens When Ink Has Dried

If ink dries within a pen point, it usually may be cleaned ultrasonically by extending the cleaning time up to about one hour. If it is still not clean the following procedure may be tried:

a. For pens 00 and larger, carefully disassemble point as shown in Figure 3-5. Plastic cap and spring will pull out; be careful not to lose spring. Pens smaller than 00 should not be disassembled due to the fine wire size of the plunger. They should be cleaned by extended ultrasonic cleaning, several hours or more, as required.

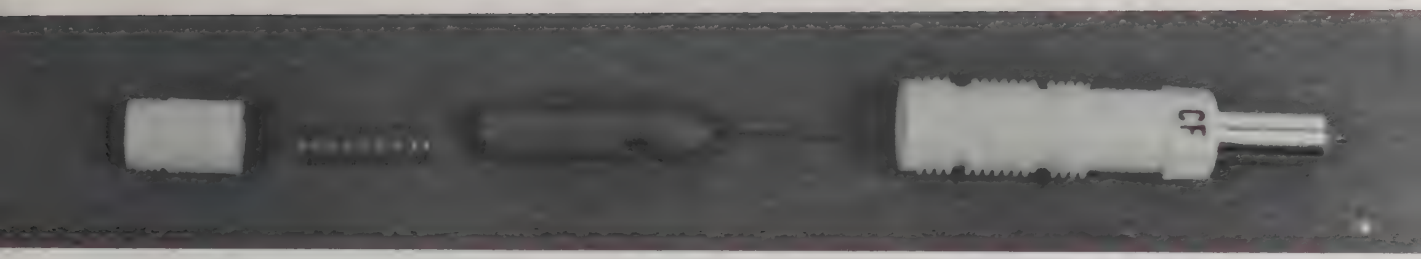


Figure 3-5 Pen Point Disassembled

b. If disassembled, inspect the pen parts for any remaining liquid ink; clean if required. Shake any excess water from the disassembled pen parts and allow to dry. The bulb may be used to blow dry the pen point body.

c. After cleaning and drying, the pen points should be reassembled, taking great care that the wire plunger is not bent. Using the point magnifier glass kit, inspect the pen point for wear as shown in Figure 3-6, 3-7.

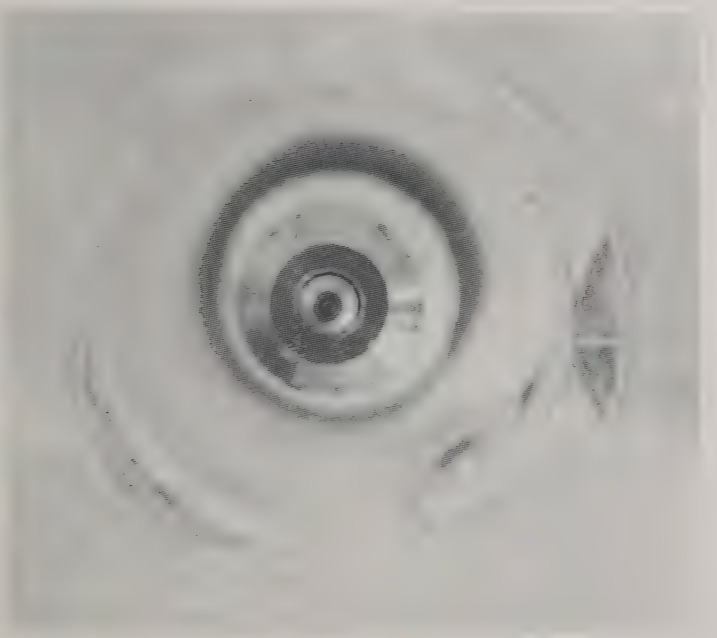


Figure 3-6 Pen Point Inspection, End View

Figure 3-7 Pen Point Inspection, Side View

## 3-8 SUMMARY OF KEY OPERATING SUGGESTIONS FOR LIQUID-INK PENS

Successful plots with liquid ink are dependent on meticulous care and cleaning. These are the steps you should follow:

a. Be sure pen is clean before each filling or before starting a new plot.

b. Make certain the point is threaded finger-tight into the pen body.

c. It is strongly recommended that all points be cleaned at the close of the work day. This ensures a start with clean pens the next day. To clean pen, use pressure bulb cleaner, pen cleaner or ultrasonic cleaner. Make sure that air channel and vent hole are perfectly clean; rinse with clear water to remove cleaning solution residues and air or blow dry thoroughly.

d. Do not shake to start a plotter pen. Plotter pens are designed differently than drafting pens. The spring inside the nib will prevent the weight/wire from moving back and forth. If a plotter pen is shaken too hard, ink will flood the air breathing system and cause blobbing or skipping after a short period of drawing. The bulb cleaner with the special nozzle attached is specifically designed to start plotter pens by utilizing the suction of the bulb.

e. If a plotter pen has been idle for a short period of time, turn the pen upside down and tap the back end on a hard surface. This will compress the spring and when it returns to its original position, the wire will push the dried ink out of the writing tip.

f. Check the radius of the writing tip and wire with a magnifying glass. A worn writing tip will collect residue and lint from the drafting surface and will either clog the point or cause it to produce wider line widths. NZC has available a special point magnifier with an adapter to accept points in the proper focused position to make this inspection easier and quicker.

g. Clean the pen and point on a regular basis.

## 3-9 BALLPOINT PENS

Ballpoint pens should be installed in the pen block/carriage as described in the User Manual for your plotter. Ballpoint pen tips should be checked for cleanliness prior to assembly. Select the desired color, then test on a scrap of plotting media to verify color and proper operation.

## 3-10 LIQUID-ROLLER PENS

Liquid-roller pens should be installed in the pen block/carriage as described in the User Manual for your plotter. Note that when not in use, **liquid-roller pens should be removed from the plotter and capped.** This will prevent unnecessary evaporation and clogging. The desired color of pen should be selected and tested to verify color and operation before using. If a pen becomes clogged, try the following procedure. Hold the pen at the top and snap smartly several times - as with shaking down a mercury thermometer. Even snapping the side of the pen against a desk edge may work. This action will frequently clear the clog and restore the ink flow.

## 3-11 NYLON-TIP PENS

Nylon-tip pens should be installed in the pen block/carriage as described in the User Manual for your plotter. **Be sure to cap both liquid-roller and nylon- tip pens when not in actual use in the plotter.** The ink will otherwise rapidly evaporate.

## 3-12 PLOTTING MEDIA OPERATION

### 3-13 Translucent

Plotting on translucent (or rag) material will provide most users with few problems. These materials are versatile in that they accept ink rapidly and require few special handling procedures. They are, however, the most susceptible to variations due to humidity. For this reason, do not leave the materials on the plotter between plots unless the humidity of the plotting environment is stable. The materials should be

covered between plots to reduce the amount of dirt that might settle on the material from the air. When installing the material on the plotter, you should use care in aligning the material evenly on the take-up roll (If the plotter is so equipped).

Inking should always be tested prior to the start of a plot. When the plot is to be used for diazo reproduction, exercise care to reduce set-off. You can minimize set-off by using high speed ink or by programming pauses in the plot when long or heavy ink deposits occur.

You should exercise care in pre-plot handling of all materials so that oil from the skin is not transferred to the material.

### 3-14 High-Quality, Glossy Bond

This paper produces **outstanding** results where plots are to be used for presentation graphics without overhead projection. Overhead projection media are discussed below under Clear Inking Film. Glossy bond is coated on one side with a glossy, brilliant white finish. This paper is subject to dimensional change with humidity. You should take the same precautions for handling as with translucent paper previously described. Superb results can be obtained with water-based nylon-tip pens. Liquid-roller and ball-point pens can be used, but without the striking appearance of the nylon-tip pens. The paper will take liquid ink well, but the results will not be significantly better than with nylon-tip pens.

### 3-15 Vellums

Vellum is manufactured by treating paper with starch, oil or resin. The treatment process improves the transmission of ultraviolet light and consequently improves the quality of diazo reproduction. However, starch base vellums are more subject to moisture; oil base vellums do not accept ink as well; and resin base vellums tend to show creasing in post-plot handling. On all vellums, ink tends to set on top of the material more than it does on paper and thus results in greater set-off. Vellum E should be handled similarly to translucent. Vellum K should be handled similarly to Mylar.

Since vellums are somewhat abrasive, you may wish to use tungsten carbide tip pens, especially when using vellum K. Inking should be tested prior to each plot.

You should exercise care in handling other materials after handling vellum since the oil in some vellums may be transferred to the other materials.

### 3-16 Mylar

Mylar is a plastic base material with a matte coating applied to the plotting surface. Mylar is the most stable material available but the matte surface is subject to some flaking and dusting. For optimum performance, it is suggested that the matte surface be cleaned before plotting. The matte surface on NZC Mylar is not water soluble. It should be wiped clean with a non-lint Kim-wipe or equivalent, moistened with alcohol prior to use. Corrections or revisions to plots may be made easily.

Inking should be tested prior to the start of each plot. Operators should exercise care in handling all matte surface materials since folds or wrinkles will cause fractures in the surface.

### 3-17 Acetate Film

Acetate is available with and without a matte coating in certain sizes. Clear acetate is usually used for overhead projection. It requires acetate solvent-based ink in either nylon tip or liquid ink pens. Matte surface acetate is available for 12-inch plotters. Although less stable than Mylar, and hence subject to humidity changes, it shares most other features with Mylar. Because of its electrostatic characteristics, acetate tends to attract dust and static cling. It should be used in a controlled environment. Inking should be tested prior to the start of each plot.

### 3-18 Clear Inking Film

Clear inking film is the best material for creating presentation quality graphics for overhead projection. Clear inking film was developed for the marketplace by NZC to overcome the difficulties encountered by users when creating transparencies with acetate film. Clear inking film eliminates the need for solvent-based inks that dry rapidly, shortening running life. This film accepts standard water-based inks and the ink dries quickly, without smearing. In addition, the static build-up and curling problems of acetate do not exist with clear inking film. The film can accept ink at speeds up to 20 ips (51 cm/s).

# SECTION IV

# FREQUENT QUESTIONS/ANSWERS

## 4-1 LIQUID INK PENS

**How can I get ink flow started?**

Cleanliness in the inking system (or the lack of it) is the major contributing factor in ink flow. Following the procedures in this manual will eliminate the majority of ink flow problems. When the user is sure that he has maintained the required cleanliness and ink flow is still a problem, the problem may be in the ink itself. If ink flow problems are experienced, proceed as follows:

a. Re-clean all components in the inking system.

b. Check for full flow of water through pen tip.

c. Check for adequate wire protrusion.

d. Check for a bent pen tip.

e. Re-assemble and attempt to restart ink flow.

f. If failure still occurs, try a new container of ink.

**Why does the ink flow stop after a few minutes?**

Ink flow may stop after a few moments because of air or dirt inside the pen tip. Re-check cleaning procedures. Air may have been trapped in the pen by shaking the assembly. If air is trapped in the pen, disassemble, clean and re-assemble. Ink flow may stop because of residual water trapped in the pen during cleaning. Remove residual water by blowing air through the pen; do not use lint-producing materials to dry pens. A clogged pen bore will stop ink flow. Pen bores may be clogged from flaking or scraping on matte surface materials or from dirt settling on plotting surface. Cover plotting surface and material when plotter is not in use. Dirt may plug pen bore in as little as three inches of plotting.

**What causes the ink to come out in blobs?**

An air leak in the assembly is normally responsible for intermittently heavy flow of ink (blobs). If this occurs, check pen tip; tighten. If leakage still occurs, check for a crack or hole in the pen tip or cartridge.

**Why does the pen fail to start on a plot when it was working fine on the last plot?**

Ink may dry on the pen tip between plots. If the expected time between plots is more than ten minutes, protect the pen tip from air by storing in a humid atmosphere or capping. Before starting every plot, clean ink and dirt accumulation from tip with lint free disposable wiper. Always prime the pen by performing a test plot using manual controls on an area of the plotting material which is not needed for the plot.

**How can I stop clogging on matte surfaces?**

All materials with a matte surface have a coating that may dust or flake during plotting. NZC supplied materials have been chosen for their resistance to dusting and flaking. If NZC materials are used, this problem will be held to a minimum. When using a material with a matte surface, run short plots and clean the pen tip often. NZC materials with matte surfaces may be cleaned before plotting by wiping the surface of the materials with a lint free wiper lightly moistened with alcohol. This will remove dirt and dust from the surface and reduce the tendency of the pen to clog.

**Why do lines get wider during plotting?**

Lines widen during plotting because of an accumulation of dirt and ink on the pen tip. Periodic cleaning of the tip with a lint free wiper will maintain a satisfactory line width. Cleaning of matte surfaces will keep accumulation to a minimum.

**Why do pens wear out so fast?**

Matte surfaces are abrasive. Tungsten carbide tip pens have a substantially longer life than stainless steel tip pens.

**Can I get blacker lines with different inks?**

Zeta supplied black inks are all rated very black at opacity of 15% of light transmission. A few blacker inks are available. However, some have an organic base solvent which may deteriorate the plastic components in pens. Zeta pen tips are resistant to this deterioration.

**How can I stop set-off?**

Use the smallest size pen which will meet the drawing requirements. Zeta high speed inks will also assist in reducing set-off. Where long lines or heavy deposits of ink are required, it may be necessary to slow the plotter or program pauses in the plot to eliminate the problem.

**Why can't I use high speed inks on multiple pen plotters?**

You can, but some programs may hold the pen in the up position for long periods of time. The ink may dry in the pen tip during these periods. Users who experience this problem may program pauses to allow for priming the individual pen tips.

## BALLPOINT PENS

**Do all ballpoint pens plot non-uniform lines?**

Lines drawn with ballpoint pens are less uniform than those drawn with liquid ink pens. Translucent is the best plotting media on which to plot when using ballpoint pens. However, where the quality requirements permit, ease in use of ballpoint pens makes them a highly desirable plotting instrument.

**Why do pressurized ballpoint pens burp sometimes?**

Pressurized ballpoint pens are manufactured with 50 to 75 pounds of pressure applied to the ink supply by a gas in the body of the pen. Variations in the density of the ink may occasionally cause the pen to deposit ink more rapidly than normal. This is very uncommon. Most of the excessive ink flow problems with ballpoint pens results from damage to the tip. Care, therefore, should be exercised when handling the pen. If the pen is accidentally dropped, examine the tip before and the line during the next plot, and discard the pen if performance is not satisfactory.

**What is the life of a ballpoint pen?**

Pressurized ballpoint pens will plot approximately three miles. Regular ballpoint pens will plot approximately one-half mile. Because of the variations in pen up and pen down time, the pen life in terms of plot time will vary significantly. Individual records within each installation will assist in determining remaining plot life in each pen.

# APPENDIX A

## GLOSSARY OF TERMS

**ACTUAL LINE DENSITY** - The characteristic of a line that affects the quality of copies reproduced by a diazo process.

**APPARENT LINE DENSITY** - The characteristic of a line that affects the quality of copies reproduced by photographic or photocopy processes.

**BALLPOINT** - An ink supply and pen tip manufactured as an integral unit. Ballpoints may depend on gravity for ink flow or they may have a gas under pressure in a sealed unit. Gravity flow ballpoint pens are referred to as regular or standard ballpoint and those with a sealed gas as pressurized ballpoint pens.

**BARREL/RESERVOIR** - The portion of a liquid-ink pen that contains the ink supply.

**CARTRIDGE** - A sealed ballpoint, liquid-roller or nylon-tip pen refill.

**CLOGGING** - The accumulation of foreign matter in the bore of a liquid-ink pen tip. Clogging restricts or eliminates ink flow.

**HOLDER** - The part of the pen assembly that holds the cartridge and fits into the pen carriage.

**PEN TIP** - The removable portion of a liquid-ink pen assembly that regulates the flow of ink onto plotting media.

**PEN ASSEMBLY** - A group of components that supply and regulate ink in a plotting system.

**PLOTTING MEDIA** - A paper or plastic sheet on which plotting is done.

**PLUNGER WIRE** - A small plastic cylinder with a wire protruding from one end. The cylinder fits into the pen body and the wire extends through the bore of the pen tip to augment ink flow.

**SET-OFF** - The transfer of ink to the back of the plotting media on drum plotters as a result of rolling the plotting media before the ink has dried.

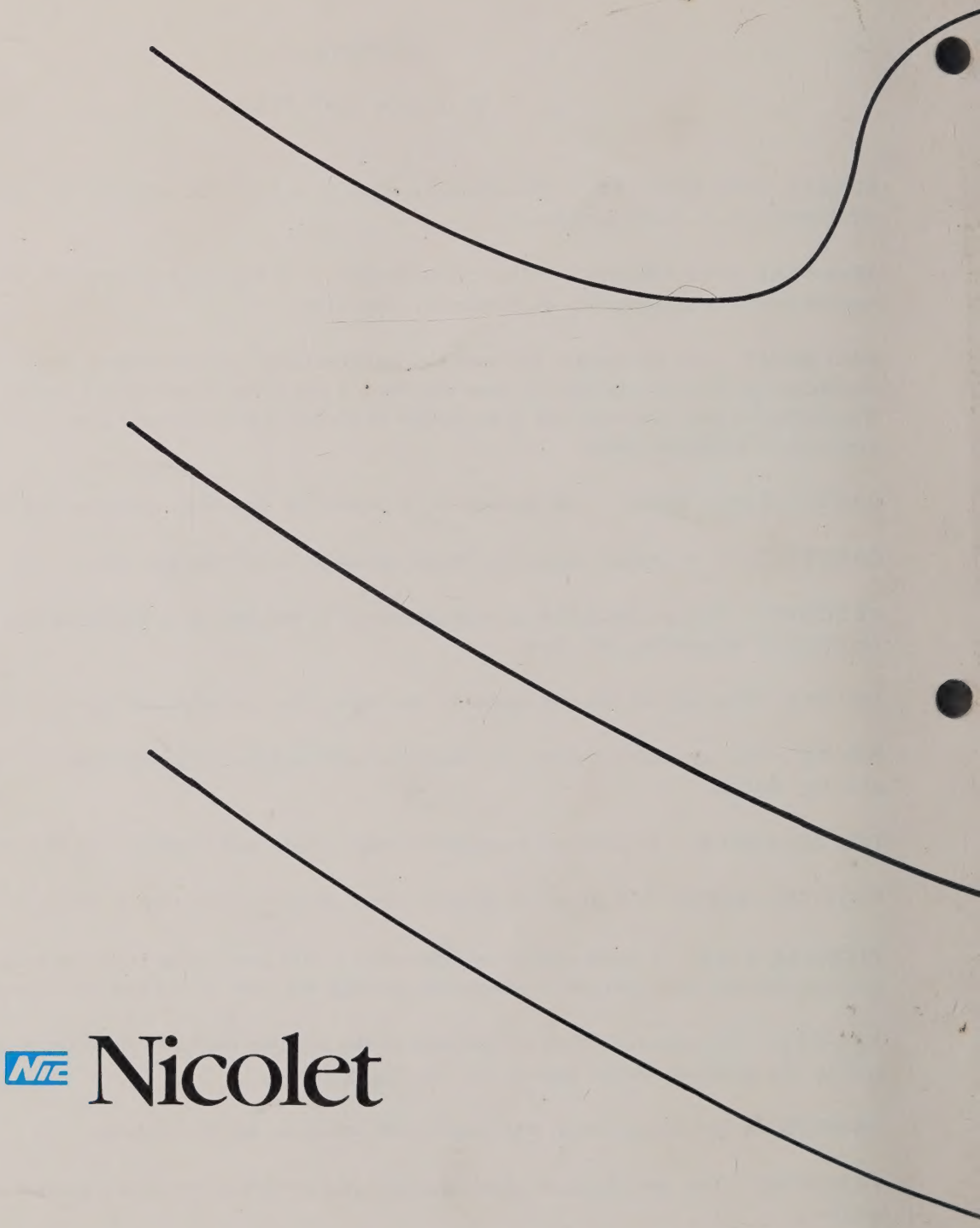
**SKIPPING** - An intermittent interruption of ink flow while plotting.

**TRACKING** - The movement of plotting media in two directions under control of a drum on a plotter.

**X-AXIS** - The longer axis of the plotting media on a drum plotter.

**Y-AXIS** - The narrower axis of a plotting media.

**Z-AXIS** - The up and down movement of a pen assembly in a plotter.



Nicolet

*Nicolet Zeta Corporation*

2300 Stanwell Drive
Concord, California 94520
Telephone 415/671-0600

December 1983

Printed in U.S.A.